

## V.—On Double Monstrosity in Fishes.

ON the 19th March last, M. de Quatrefages exhibited to the French Academy of Sciences a living specimen of a double monstrous Fish. The observations made by M. de Quatrefages on the occasion of this exhibition have given rise to a discussion upon the phænomenon of double monstrosity in Fishes, in which several of the most distinguished physiologists of France have taken part, and although, as might be expected from the nature of the subject, no very decisive results have been obtained, there seems to be every reason to hope, from the zeal with which these gentlemen appear to be devoting their attention to the solution of the interesting question of the mode of production of these monstrosities, that their researches may eventually throw considerable light, not only upon the particular phænomenon in question, but also upon the origin and development of the normal embryo. For this reason we have thought it advisable to give a short account of some of the leading statements that have been made, in the hope that by so doing we may call the attention of some of our readers to this interesting subject.

The monster exhibited by M. de Quatrefages had been observed by him for a period of nearly two months. When he first received it, it consisted of two young fishes, completely separated from each other and adhering to the opposite sides of a vitellus, which exhibited a deep notch in front. Each of these embryos exhibited a certain amount of deformity,—one, the largest, had the face deformed and the eyes entirely wanting, whilst the other parts of the body were perfectly developed;—in the other the head was well-formed, the body humped and the tail twisted. The two abdominal veins (afterwards converted into the *venæ portæ*) were in their usual position, and their ramifications spread over the whole surface of the vitellus, communicating at their extremities with the roots of the vitelline veins, which afterwards form the hepatic veins. It is remarkable also that numerous anastomoses united the last ramifications of the abdominal vein of each embryo with those of the vitelline vein of the other, so that a continual interchange of blood took place. [According to M. Coste the circulation in double monsters is common to the two embryos,—the greater part of the blood which has circulated in the body of one passing into the vessels of the umbilical vesicle [abdominal vein], whence the greater part of it is conveyed by the vitelline vein to the auricle of the other embryo and so on, and in accordance with this reciprocal circulation the contractions of the two ventricles take place alternately.

M. de Quatrefages, however, states that such was not the case in two instances observed by him.]

On the 19th February, nearly a month after the specimen came into the possession of M. de Quatrefages, and about six weeks after its exclusion from the egg, the two embryos were close together and ready to unite on one side of the abdomen, whilst on the other they were still separated by a considerable space occupied by the vitellus. When exhibited to the Academy, the vitellus was nearly gone, and the larger of the two was nearly ready to feed. It had originally been placed to the right of the vitellus, but had become superior, lying somewhat across the smaller and more deformed individual, which it carried about with it.

The conclusion at which M. de Quatrefages arrives with regard to this monster is, that it is formed by the coalescence of two originally distinct embryos, and that the vitellus from which it was developed was also double, the point of junction being in his opinion indicated by the deep notch already mentioned at the anterior part of the vitellus. This opinion is also shared by M. Serres.

M. Coste however maintains that there is only a single vitellus and umbilical vesicle, since at whatever period these monsters may be observed, the vesicle is always simple; and this view is further supported by the intimate connexion between the circulatory systems of the two embryos. He considers that as the external lamina of the umbilical vesicle really forms a common abdominal wall enclosing the vitellus, it is impossible to regard the two embryos as distinct individuals developed at the poles of a double vitellus and becoming coalescent at a late period of their growth, as they are actually united from the first into a single organism by this membrane, and their subsequent union is only effected by the gradual contraction of this membrane as the vitellus becomes absorbed. This conjugation is consequently a primordial phenomenon, and of a much more intimate nature than one of simple adherence, such as the case cited by M. Geoffroy Saint-Hilaire, in which two chickens, hatched from two separate yolks contained in the same egg, were found to adhere to one another by the belly.

M. Lereboullet holds the same opinion with M. Coste, regarding the primitive simplicity of the vitellus, and his observations (made upon the eggs of the Pike) appear to be tolerably conclusive upon this point. He states that in the eggs of the Pike the development of the embryo commences at the moment when the blastoderm has almost completely enclosed the vitellus, by the formation of a small triangular tubercle on the blastodermal ridge (*bourrelet blastodermique*), and that from this

centre the embryonic fillet takes its rise. In many cases the ridge of the blastoderm bears two tubercles, from each of which an embryonic fillet is produced, and the further development of these gives rise to double embryos of various kinds. It appears from a statement of M. Lereboullet, that the formation of these monsters may be determined at pleasure by placing the eggs in unfavourable conditions for development.

M. Lereboullet describes the formation of several varieties of these double monsters. 1. In some instances two tubercles were produced on the margin of the blastoderm, from each of which proceeded a fillet furnished with a dorsal furrow, forming two embryos adhering to the marginal ridge. Soon afterwards the divisions of the vertebræ made their appearance, the external ones having their ordinary form and dimensions, whilst the internal gradually became confounded, passing from the body of one embryo to that of the other, thus causing the partial amalgamation of the two embryos. In this manner a double fish is formed, arising from two primitive germinating points produced upon the blastodermal ridge, so as to become partially joined; it has therefore two separate bodies with a common tail. A specimen of this description, in which the fusion of the double embryo had extended to about the middle of the body, lived for four days after exclusion from the egg.

2. In other eggs the blastodermal ridge gave rise to a long and broad fillet terminated anteriorly by two rounded lobes. Two parallel furrows made their appearance in the fillet, and soon exhibited the vertebral divisions, whilst the anterior lobes acquired a determinate form, and each produced two ocular vesicles, constituting an embryo with a single body and two distinct heads. In these cases however the duplicity was transitory; the two heads soon came in contact, and became soldered together in such a manner as to form only a single head. M. Lereboullet has observed these phenomena in about fifteen instances, but could never ascertain in what manner the fusion of the two heads was effected. In some cases the two heads appear to remain distinct.

3. One of the most remarkable monstrosities is that presented by some embryos with a single head, two separate bodies, and one or two tails. These are formed in the following manner:—the ridge of the blastoderm, which has the form of a gaping button-hole, produces a single cephalic tubercle, but the formative process goes on in the whole circumference of the margin, each half of which acquires a *chorda dorsalis* and a nervous cord, and soon exhibits the divisions of the vertebræ. When the cephalic tubercle is short and only gives rise to the true head, each of the two bodies is furnished with two auditory capsules,

two pectoral fins and a heart ; but when this tubercle is more elongated, the anterior part of the body is simple, and bears two eyes, two auditory capsules and a single heart, and the body is terminated posteriorly by two short branches.

4. This organization of the ridge of the blastoderm into a double embryo seems to explain an extremely curious form which only occurred once in M. Lereboullet's observations. This consisted of a simple embryo, bearing on the right side of its body a small tubercle, directed backwards, and terminated by an auditory capsule and an active heart. The production of this form is accounted for by the resorption of the parts of the body posterior to the heart in one of the embryos, and M. Lereboullet has witnessed the complete disappearance of one of the bodies in other instances.

5. In another egg the ridge of the blastoderm exhibited two contiguous tubercles, of which one had the ordinary form of the cephalic tubercle, whilst the other was smaller and irregular. The former alone acquired a furrow and gave rise to an embryo, on one side of which the smaller tubercle was borne.

6. Occasionally bodies furnished with three heads make their appearance. One of these is described by M. Lereboullet. It was a double embryo, composed of two bodies united behind, but quite free in front. One of these bodies was of the normal form ; the other bore two heads, of which that on the left was of the normal form and furnished with two eyes, whilst that on the right only bore the right eye, the union of the two heads being effected at the point where the left eye ought to have been. This singular embryo was still in the egg when described ; it had two hearts, one common to the two principal bodies, situated at their bifurcation, the other placed in the angle of union of the two heads.

M. Lereboullet explains the formation of this anomalous creature in the following way. He considers that two fillets have been formed, one of which has been terminated by two cephalic lobes and acquired two furrows (as described under 2.), whilst the other has remained simple. These two embryos have then united posteriorly (as under 1.), producing an embryo with one tail, two bodies and three heads.

7. An extraordinary result was obtained when the development of the eggs was retarded by a considerable diminution of temperature. In this case the ridge of the blastoderm produced no embryo, but contracted gradually like the opening of a bag, its substance becoming condensed and forming a mammillated tubercle projecting from the surface of the vitellus. This tubercle continued living, rose more and more from the surface, acquired a lingulate form, and at last constituted an elon-

gated body, narrowed in front, divided transversely into vertebral lamellæ, *without dorsal cord, or sensitive organs, but furnished with a heart*, of which the contractions were sometimes very lively.

These observations, as M. Lereboullet well observes, appear to prove that the generally received opinion that double monsters are produced by the fusion of two embryos is perfectly correct, whilst that which attributes a separate vitellus to each of these embryos is not founded in fact. He considers that his observations, with those of Valentin, show that there is only a single germ, but that this, by becoming developed in two directions, instead of one as in normal cases, gives rise to two more or less distinct embryos. In his opinion the ridge of the blastoderm (*bourrelet blastodermique*) plays a most important part in the formation of the embryo, and in fact constitutes the "true embryonic germ, which is always simple and single, like the vitellus which is covered by the blastoderm, but when its development is deranged from its regular course, is capable of vegetating like the substance of which the bodies of polypes are composed, so as to produce various forms, which however, in their subsequent development, always show a distinct tendency to return to the original type of the species."

## PROCEEDINGS OF LEARNED SOCIETIES.

### LINNÆAN SOCIETY.

December 5, 1854.—William Yarrell, Esq., V.P., in the Chair.

Mr. Ward, F.L.S., exhibited two sets of specimens of *Asplenium lanceolatum*, from Jersey, both found growing on disintegrated sandstone, exhibiting a striking difference between the growth of the same species on an open sunny bank and in dense shade.

Mr. John Hogg, F.R.S., F.L.S., exhibited some scales, and a piece of the scaly covering which was cut from the back of a large fish found in the river Tees, in September of this year. He stated that two fishermen observed a great fish—such as they had never before seen—left by the tide on a sand-bank, in the estuary of the river Tees. They described it as having the head of a salmon, with the back-fin like that of a perch, erect, and somewhat spiny, and the tail spreading and much curved. The colour they did not mention, except that of the back, which was represented as being of a purplish-black. They likewise particularly observed some large scales on the front of the fish near the gill-covers, one of which Mr. J. Hogg also exhibited, and which is of a very strong bony texture. From the account of this fish so given, Mr. Hogg conceived that it could only have been a large Tunny (*Thynnus vulgaris* of Cuvier), which had been stranded whilst in pursuit of herrings or other small